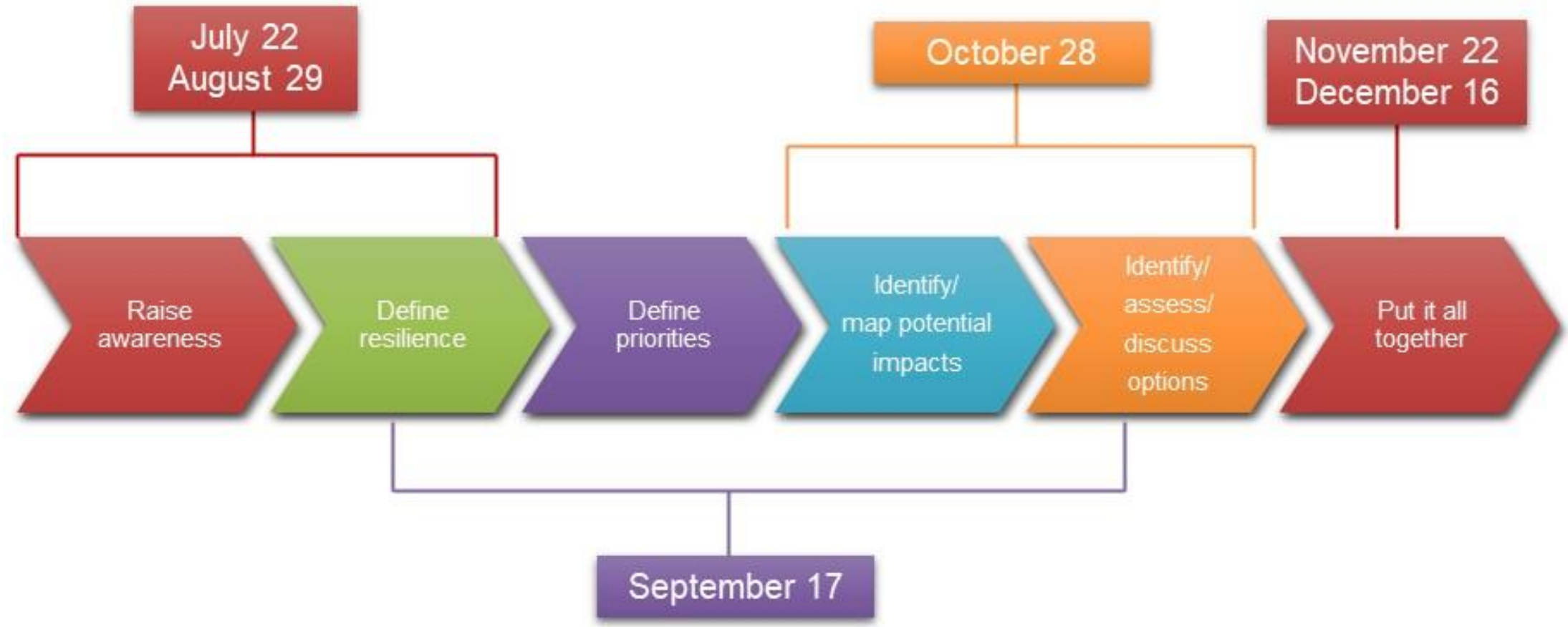
Hawaiian Electric

Resilience Working Group Recap Stakeholder Council Pre-Read

November 9, 2021

Six RWG meetings over six months



We built consensus on a definition of “resilience”

STATE OF HAWAII
PUBLIC UTILITIES COMMISSION

“Resilience is the ability of a system or its components to adapt to changing conditions and withstand and rapidly recover from disruptions.”

Hawaii Public Utilities Commission Staff, PBR Docket

Regarding the electric power system, this can be interpreted as the ability to anticipate, absorb, adapt to, and rapidly recover from a catastrophic event.

We defined objectives for resilience

- Reduce the likelihood of power outages during a severe event
- Reduce the severity and duration of any outages that do occur during and after a severe event
- Reduce restoration and recovery times following a severe event
- Return critical infrastructure customers' power rapidly to enable mutual support and recovery during an emergency
- Return all customers within appropriate times
- Limit environmental impacts of a severe event

We prioritized resilience threats and developed threat scenarios

Recommendation on Threat Scenarios

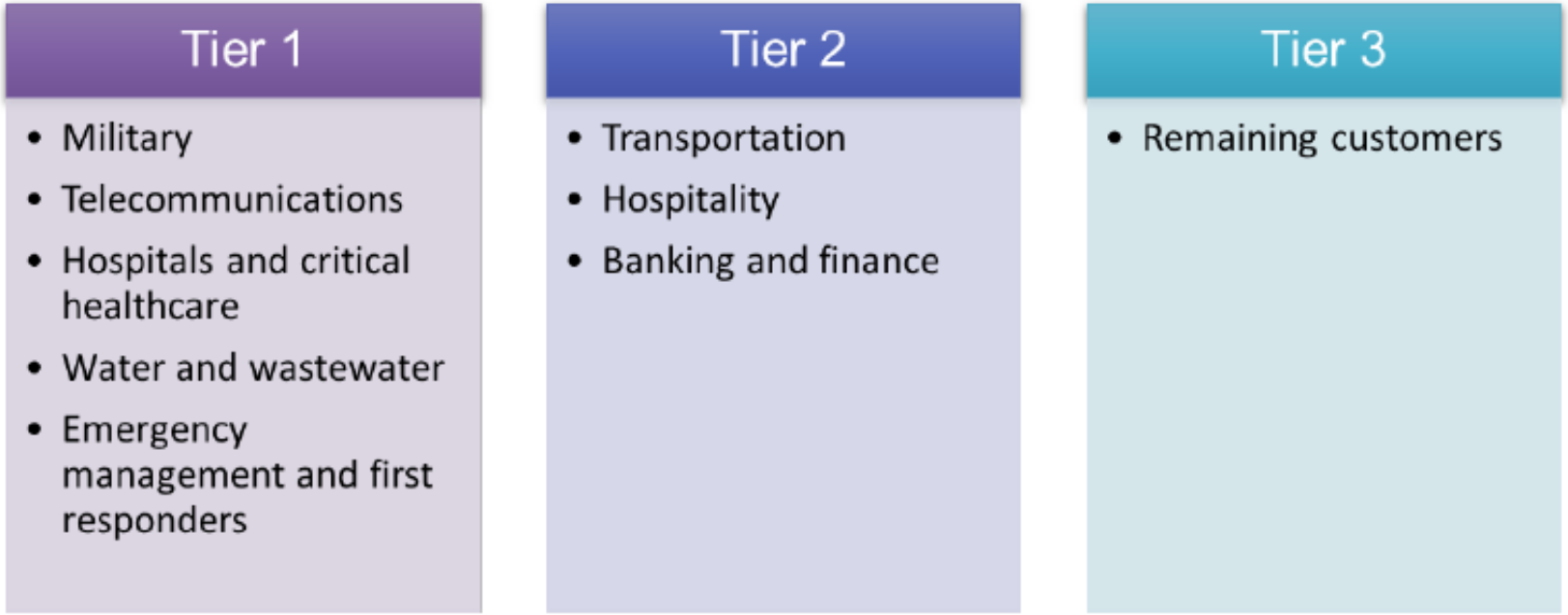
The following threat scenarios to be used by the Utilities to guide the IGP process and other resilience initiatives, and also by key customers and critical infrastructure partners in developing resilience preparations.

- Hurricane/flood/wind
- Tsunami/earthquake
- Wildfire
- Physical and cyberattack
- Volcano

Threat	Includes	Oahu	Hawai'i	Maui County
Hurricane	Flood, Wind	◆	◆	◆
Tsunami	Earthquake	◆	◆	◆
Wild Fire		◆		◆
Physical Attack	Cyber Attack	◆	◆	◆
Volcano			◆	

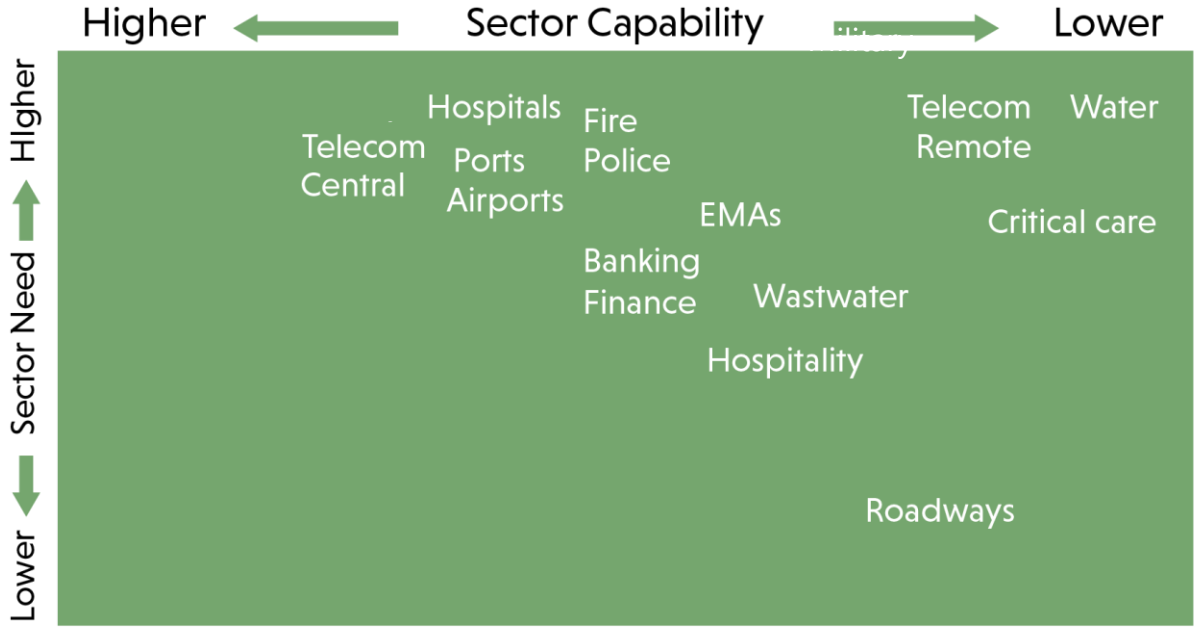
We prioritized key customers and infrastructure sectors

Exhibit 24: RWG Recommended Customer Classifications by Tier



Capabilities of Key Customers and Infrastructures

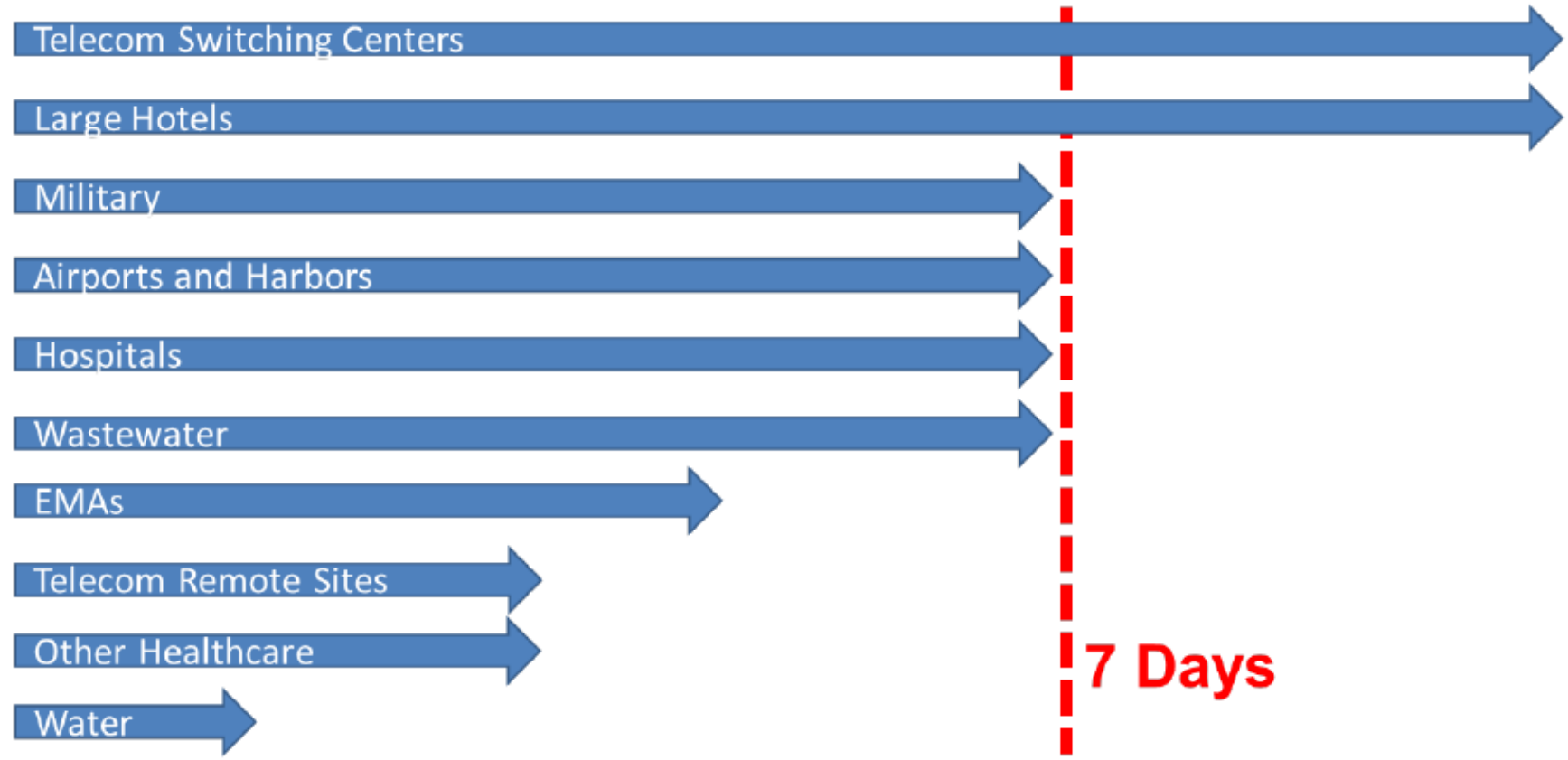
- Prioritizing Customers and Infrastructure Sectors
- Key Customer Capabilities and Needs
- Opportunities for Critical Customers to Improve Resilience from Loss of Power Events



Even the most cabable sectors are limited to 1 week or less without refueling

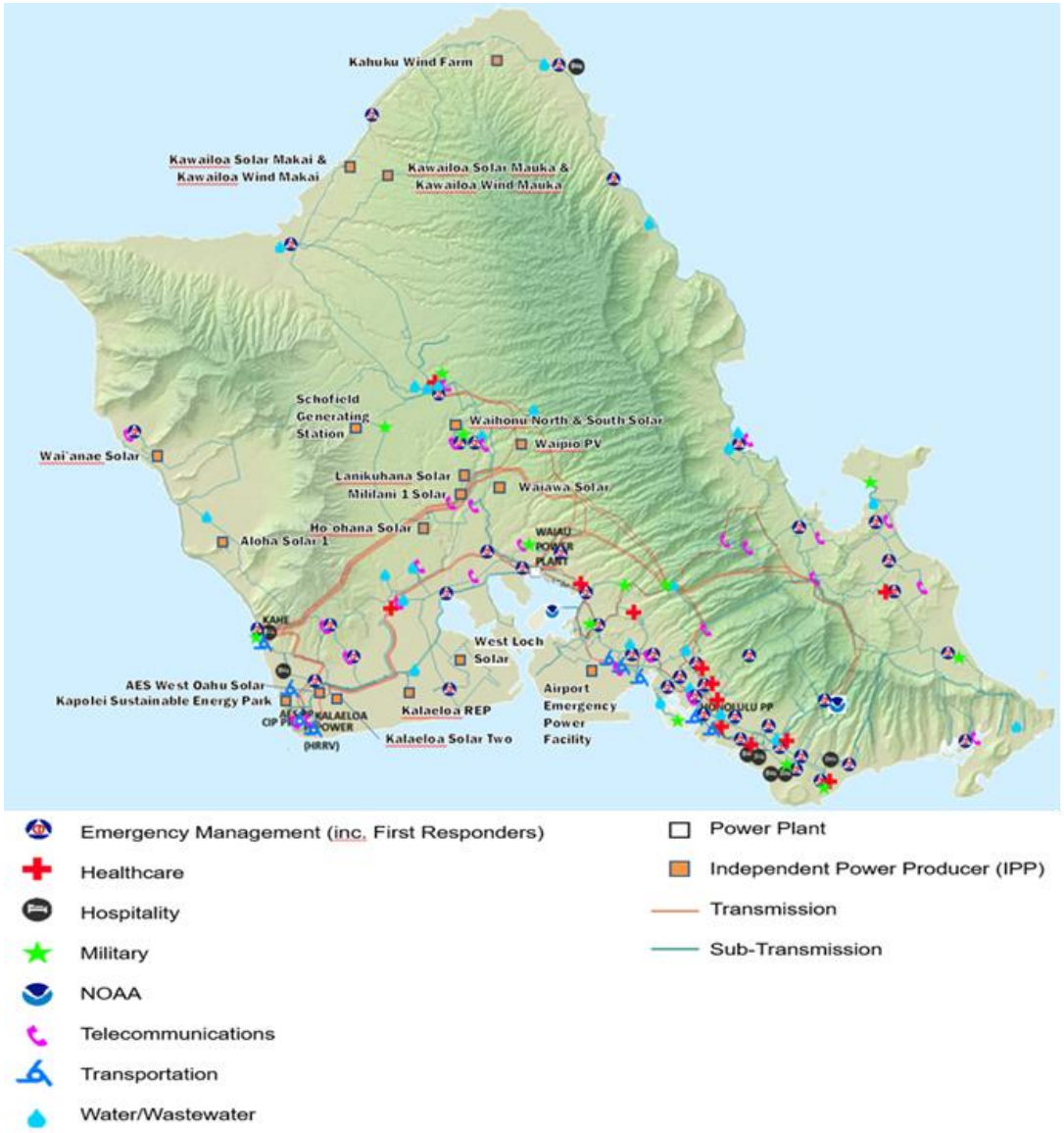
We identified key customer capabilities and needs

Exhibit 25: Summary of Backup Power and Fuel Capabilities



We identified opportunities to improve grid resilience for each island

- Characteristics of power grid on each island
- Additional options for improving grid resilience



We developed recommendations for the IPG process

- Consider the following threat scenarios in developing resilience preparations: hurricane/flood/wind, tsunami/earthquake, wildfire, physical & cyber attack, volcano
- Consider key customer and infrastructure priorities identified by RWG when planning system expansion and improvements
- Develop IGP objectives that include optimizing resilience and cost of resilience; and merge resilience with other planning goals
- Consider all possible lowest cost solutions, whether they are best accomplished solely through utility actions or through a combination of utility customer and other service provider actions
- All relevant costs should be captured, which includes the costs that Utilities might incur to mitigate (and recover from) severe and catastrophic outages, as well as the cost of the outage to customers and other stakeholders; it might also include costs that customers or other service providers incur in response to and recover from the consequences of a prolonged severe outage Develop measures of resilience to allow evaluation of resilience performance of various options or combination of options under assumed scenarios and conditions
- Resilience should not only be measured as a cost but should be a separate goal with its own measurable outcomes. This step requires the definition of each individual resilience goal and quantification of the degree of resilience achieved in a single and/or combination of metrics
- Consider options for more DER and non-wires solutions
- Consider configuring portions of the grid in several mini grids that could operate as independent islands which could
- Consider planning for best locations to expand and diversify blackstart resources and delivery paths to support grid restoration and timely recovery of key customers and critical infrastructure sectors
- Consider targeted transmission/sub-transmission additions to enhance redundancy and diversity of delivery paths and reduce risk from severe events

We developed recommendations for key customers and infrastructure partners

- Infrastructure owners and operators work together in close partnerships to coordinate disaster planning and recovery. Recovery and risk mitigation are shared responsibilities between the power companies, key customers and the government
- Key customers develop and implement load management/load curtailment capabilities to limit power usage to mission critical loads during emergencies with loss of offsite utility power
- Key customers maintain ample onsite fuel supplies for generators during extended power outages and transportation disruptions and have in place plans and fuel supply arrangements resupply fuel for outages exceeding operational expectations; coordinate resupply plans so that multiple facilities, sectors, and geographic areas are not relying on the same fuel resources at the same time; provide backup power sources that can supply essential loads during prolonged outages and emergencies; test and exercise backup power resources
- Under their Continuity of Operations Planning (COOP), key customers should consider relocating essential functions to alternative facilities at sites/locations with more robust infrastructure support
- Key customers consider developing plans and arrangements for deployment of temporary emergency power generators that can be relocated to critical sites during prolonged outages
- Key customers consider partnering with Utilities and the government to develop local microgrids for power that can be isolated from the grid when needed (during severe events); consider alternative technologies, such as renewables and storage, and other blackstart resources
- Key customers in the transportation sector ensure availability of adequate road clearing equipment to speed recovery of key roads, ports and airports
- Key customers reinforce harbors and port facilities against catastrophic flooding and storm damage to ensure they can maintain maritime operations during extended power outages
- Customers maintain training and exercise programs that address performing emergency and contingency operations with loss of utility power

We developed recommended actions for the utility to take in parallel to the IGP process

- Harden critical transmission circuits
- Establish priority circuits with enhanced restoration capabilities and greater hardening
- Consider alternative paths for transmission circuits to increase diversity of location and enhance performance during severe events
- Expand underground cables and locate equipment outside flood prone areas
- Enhanced vegetation management
- Develop wildfire mitigation strategies for worst case wildfire event at Maalaea
- Continue to explore and develop advanced resilience data
- Partner with key customers and government to develop microgrids
- Reinforce fuel resupply options by increasing distributed storage and delivery capability for severe event emergencies
- Plan for additional crews during emergencies and provide more robust and regular training for emergency situations
- Expand critical resources, supplies, backup equipment, and materials to restore damaged circuits, substations or generators, more quickly following severe events
- Plan for emergency access to additional helicopters on the islands to support repairs in remote, difficult to access sites
- Continue efforts to enhance physical and cyber security of assets, resources, and systems.
- Require that new RFPs for renewables bids include grid-forming inverters
- Consider adopting advanced technologies in a more distributed resource approach, including grid-forming renewable energy sources, battery storage, and joint projects with key customers to provide microgrid capabilities for emergency and backup operations
- Develop and test capabilities of expanded use of drones for emergency response and regular maintenance inspections
- Evaluate options for distribution automation, digital meters and associated communications networks which can be valuable in assessing system conditions, the extent of outages, and how to best prioritize recovery efforts to get key customers reenergized more quickly
- Consider actions to reduce tsunami risk impacting generation in inundation zones on O‘ahu

For Reference

- Resilience Working Group Documents
  - RWG Final Report
  - Presentation Slides
  - Meeting Summary Notes
  - Breakout Session Results

https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-engagement/working-groups/resilience-documents